APCT CENTER VENDOR GUIDE FOR VERIFICATION OF MOBILE SOURCE RETROFIT EMISSIONS CONTROLS

1. INTRODUCTION

This guide is intended to help applicants to the Air Pollution Control Technologies Verification Center (APCT Center), a center under the EPA's Environmental Technology Verification (ETV) Program, understand the verification process and their role and responsibilities. The guide addresses manufacturers' use of ETV data to list their technologies on EPA's Office of Transportation & Air Quality's National Clean Diesel Campaign (NCDC) verified retrofit technologies list. ETV and NCDC are separate but complementary programs run by separate offices within the EPA.

1.1 APCT Verification Center Background

EPA's ETV Program (**http://www.epa.gov/etv/**), funded by EPA's Office of Research and Development (ORD), verifies the performance of commercially available, innovative or improved technologies as an independent third party. Verification tests generate credible performance information with quality-assured data approved by EPA. The ETV Program addresses problems that threaten human health or the environment; it was designed to accelerate the entrance of new environmental technologies into the domestic and international marketplace. RTI International[1] is partnering with EPA for the ETV APCT Center. The APCT Center (**http://www.epa.gov/etv/centers/center5.html**) addresses control technologies for both stationary and mobile air pollution sources. For mobile source retrofit technologies, the APCT Center worked with EPA's Office of Transportation and Air Quality (OTAQ) and interested stakeholders representing manufacturers and end users to develop verification test protocols.

1.2 NCDC Background

The objective of OTAQ's NCDC (**http://www.epa.gov/diesel/**) is to evaluate the emissions reduction effectiveness of retrofit technologies and provide stakeholders with confidence that these technologies will achieve quantifiable emissions reductions. This verification process will evaluate the emission reduction performance of retrofit technologies, including their durability, and identify engine operating criteria and conditions that must exist for these technologies to achieve those reductions.

1.3 Relationship between the ETV APCT Center and NCDC

ETV measures the performance of a given technology using a specified fuel on a specified engine tested under specified loading cycles and issues verification reports and statements on the results of that unique configuration. NCDC evaluates the data generated by ETV to apply emissions reductions from the single verified configuration to a broader sector, such as the engine family that includes the make and model used for verification. Data generated outside the ETV program may be submitted to OTAQ to support applying emissions reductions to a broader engine definition; however, ETV verification reports and statements are generated only for testing conducted under the ETV program. The table below identifies the roles of these two separate and independent organizations when they work together to verify technologies.

[1] RTI International is a trade name of Research Triangle Institute

Environmental Technology Verification Program (ETV) EPA Office of Research and Development	National Clean Diesel Campaign (NCDC) EPA Office of Transportation & Air Quality
• Coordinates testing with EPA-OTAQ • Audits ETV testing organizations • Prepares test/QA plan • Estimates costs of verification tests • Conducts ETV tests • Issues ETV verification reports and statements	• Evaluates technologies to understand in-use performance and applicability to different engine and vehicle technologies. • Evaluates total application package • Interprets emissions reductions data from ETV • Sets emissions reductions for technologies and posts on NCDC website • Extends applicability to other engines (and adds requirements for additional data) • Requires in-use testing of technologies.

1.4 Applying to the APCT Center/NCDC

The NCDC application is available as an Excel spreadsheet on the EPA OTAQ website at **http://www.epa.gov/otaq/retrofit/retrofittech.htm**. The application requires detailed descriptions of the product, components, and test results, as well as contact information for the manufacturer's designated technical authority. For simplicity, the same application may be used for the ETV program.

OTAQ requires a thorough technical understanding of how the technology works before it will be considered for verification. To ensure OTAQ acceptance of the data, its requests for information must be fulfilled before a test plan can be finalized and verification can proceed.

1.5 Protocols and Test Plans

Stakeholders representing federal, state, and local government agencies; manufacturers; end users; trade associations; and testing organizations developed three protocols to cover technologies in the mobile sources area. The Devices protocol provides the requirements for verification of the performance of diesel exhaust catalysts, particulate matter filters, and engine modifications applied to highway and nonroad diesel engines. The selective catalytic reduction (SCR) protocol provides the requirements for verification of SCR systems applied to highway and nonroad diesel engines and some categories of stationary engines. The Fuels protocol provides the requirements for verification of emissions reductions achieved by fuel modifications and reformulations, alternative fuels, and lubricants applied to highway and nonroad diesel engines and light-duty gasoline engines. All three protocols are available on the EPA ETV website (**http://www.epa.gov/etv/verifications/protocols-index.html**) in portable document file (pdf) format. The protocol sets the requirements for testing. The verification tests are based on Federal Test Procedures detailed in the Code of Federal Regulations. Highway engine testing is based on 40 CFR 86, Subpart N (40 CFR 86.1301). Nonroad engine testing is based on 40 CFR 89, Subpart E (40 CFR 89.401). Test/QA plans are developed that document how the protocol will be implemented by a testing organization. These documents are in place before verification testing may begin in a technology area. A technology-specific addendum documents the vendor, the technology, how many tests are required to distinguish the expected emissions reductions from normal test variability, and decisions on optional measurements.

1.6 The Verification Process: Step by Step

The verification process follows the steps listed below:

- *The vendor initiates the verification process by submitting an application to the APCT Center and OTAQ.* The application form is posted as an Excel spreadsheet on the OTAQ NCDC website (**http://www.epa.gov/otaq/retrofit/retrofittech.htm**). It is listed under Specific Verification Documents as part of the Retrofit Technology Application Packet. The APCT Center uses the same application to reduce the paperwork burden on the applicant and is primarily interested in the technical and contractual contacts, identification of the specific technology to be verified, a general description of the technology and how it works, how it should be installed, and what the claimed emissions reductions are. OTAQ requires a thorough and complete understanding of the mechanism by which technologies reduce emissions and may require the submission of information that may be considered by the applicant to be confidential business information (CBI). EPA can maintain CBI in accordance with applicable regulations. Generally, the APCT Center will not need to receive any proprietary information.
- *The applicant, the APCT Center, and the testing organization discuss the intent of the test and develop a testing outline.* If the applicant wishes to apply to the NCDC, OTAQ is included in the discussions. If the applicant plans to submit the data to California Air Resources Board (CARB), that agency can also be brought into the discussions. The manufacturer should have a thorough understanding of his intended market and application of the technology to that market to facilitate the discussions. These discussions are usually conducted as a series of conference calls, but may include meetings. During the discussion, OTAQ may bring up questions about the technology and how it operates. Depending upon how quickly issues are resolved, the discussions may require multiple calls and the submission of additional technical information.
- *After the initial discussions have been completed, the APCT Center prepares a contract outlining Terms & Conditions, Statement of Work, and Cost.* The Terms and Conditions include provisions and guidelines for use of the ETV logo.
- *The applicant approves and returns a signed copy of the Terms & Conditions with full payment.*
- *The APCT Center and its testing organization (with input from the applicant) prepare a test plan addendum, to be approved by EPA, by following the applicable protocol.* The addendum specifies the number of tests necessary to guarantee a 90% probability of detecting the expected emissions reductions. More data are needed for low emissions reductions.
- *The applicant provides degreened and aged devices and the engine intended for verification testing to the testing organization.* The applicant is encouraged to provide one degreened device and one aged device. The applicant may choose to suspend the verification process after testing in the degreened condition so the same device can be aged. The delay between testing the device in the degreened condition and the aged condition requires an additional series of baseline tests.
- *Testing is conducted.* The applicant is responsible for providing to the testing organization the test engine and the system(s) to be verified as well as installation and operation instructions. In some cases, an inspection and functional test may be required to ensure that the unit is operating as it is supposed to before testing begins.
- *A test report is prepared by the testing organization and submitted to the APCT Center*.

- *The APCT Center submits a draft verification report and verification statement to EPA.* The reports are subject to peer, technical, and quality assurance reviews at EPA. The applicant has an opportunity to comment on the report before it is submitted to EPA.
- *EPA approves and signs the verification report and statement.* Verification statements are signed by the Director of EPA's National Risk Management Research Laboratory of the Office of Research and Development and the Director of the APCT Center.
- *The APCT Center releases the verification statements and reports.* The EPA ETV program administrator posts the verification report and statement on the Center and EPA ETV web site so they are available to the general public and distributes copies to the applicant and EPA. The applicant may use the ETV reports, statements, and logo for marketing as described in the Terms and Conditions in the contract package.

2. PRETEST ACTIVITIES & DISCUSSION

2.1 Verification Scope

Several key issues addressed during development of the statement of work affect how OTAQ will extrapolate the emissions reductions to a broader scope. They include selection of the test engine, test fuel, and the test cycle. Applicants should make these choices to best match the verification to their intended market for the technology.

EPA groups engine families into boxes with similar characteristics for current and past model years. For highway engines, families are categorized by emissions standards and either urban bus or non-urban bus. Each box has 6 subgroupings: stroke technology (2- or 4-stroke) and engine classification (LHDDE, MHDDE, HHDDE). The emissions reductions are verified by ETV for only the specific engine model and fuel combination tested. To extend the emissions reductions to other engines within the same engine box, the applicant may petition OTAQ and submit additional data. Engine box classifications are posted on OTAQ's website for both highway engines (**http://www.epa.gov/dieselretrofit/documents/engfamoh.pdf**) and nonroad engines (**http://www.epa.gov/dieselretrofit/documents/engfamnr.pdf**).

2.2 Developing the Statement of Work

What engine will I use? The engine selected for verification testing must be representative of the intended market. ETV requires the model year, make, model, engine serial number, date of manufacture, displacement, service class, EPA engine family, record of service hours or miles, and record of maintenance, repairs, recalls, and damage. The applicant is responsible for providing the engine for verification testing. The testing organization may offer a suitable engine for a fee but is not obligated to do so.

What fuel will I use? Testing may be conducted using either 2D standard diesel fuel or ultra low sulfur diesel fuel (ULSD). In some cases, the applicant may choose to use an alternative fuel specific to its intended market. The same fuel must be used for both the baseline and controlled tests. The testing organization provides the fuel for verification testing.

What test cycle will I use? Transient cycles are used to load highway heavy-duty engines; verification testing may also include a steady-state Supplemental Emissions Test. Multi-mode steady-state cycles are used to load nonroad compression ignition (CI) engines; verification testing may also include a nonroad transient cycle. The cycle generated during the baseline test is used to load the engine with the degreened and aged technologies installed; new cycles are not generated. Backpressure and exhaust temperature are monitored.

Do my products meet the requirements for degreening and aging? Degreened retrofit devices must have between 25-125 hours of service life; aged devices must have more than 1000 hours of service life. Field use is the preferred method for accumulating service hours on the aged device. The aging must be appropriate for the test engine and representative of the intended market. ETV requires the same engine information on the engines used for aging and degreening as for the test engine. Documentation of aging and degreening must include the serial numbers of the control technologies and these serial numbers must match those cited in the statement of work.

3. SIGNING A CONTRACT

Upon completion of a satisfactory Statement of Work (SOW), the applicant will sign a contract with RTI to conduct the verification test. The contract includes Terms and Conditions with guidelines for proper use of the ETV Program name and international logo, the Statement of Work, and price and payment terms. The SOW describes the system(s) to be verified, and outlines the testing procedure. The price of the verification covers the cost of testing and reporting. Applicants are required to remit payment when returning the signed contract package.

4. TESTING

Southwest Research Institute is currently the authorized testing organization for verification of mobile source control technologies under the APCT Center. Testing is conducted at their facility in San Antonio, TX. ETV is an open transparent process. Applicants and their guests can witness testing of their technology. Changes to the ETV test/QA plan are not permitted once testing has started.

5. REPORTING

5.1 Results

Results are reported as the percent mean emissions reductions and 95% confidence limits for particulate matter (PM), nitrogen oxides (NOx), hydrocarbons (H), and carbon monoxide (CO) compared to the baseline.

If the confidence interval includes zero reduction, then the performance is reported as not distinguishable from zero. The vendor can opt for no verification statement under these circumstances; however, a verification report with the results is issued and posted to the website.

5.2 Deliverables

The applicant will receive originals of the verification report and verification statement. The statement will be signed by the director of the National Risk Management Research Laboratory of EPA's Office of Research and Development and the director of the APCT Center. Portable document format (pdf) versions are also posted to the EPA ETV website.

6. REFERENCES & LINKS

EPA ETV Program website:
http://www.epa.gov/etv/

EPA National Clean Diesel Campaign:
http://www.epa.gov/diesel/

Code of Federal Regulations:
http://www.gpoaccess.gov/cfr/index.html

7. CONTACT INFORMATION

For more information about RTI or the APCT Center, contact:

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